Journal of the Society of Arts.

FRIDAY, MARCH 12, 1869.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at eight o'clock:—

MARCH 17.—"On the Trade and Commerce of Japan." By WILLIAM DAVISON, Esq.

MARCH 24.—*Passion Week.*—NO MEETING.

MARCH 31.—"On Technical Education, considered in relation to Female Schools." By ELLIS A. DAVIDSON, Esq., Lecturer on Science and Art in the City of London Middle Class Schools. The Rev. Wm. Rogers, Rector of Bishopsgate, Member of the Council, will preside.

APRIL 7.—"On the Theory of Boiling in connection with some processes in the Useful Arts." By CHARLES TOMLINSON, Esq., F.R.S., F.C.S.

APRIL 14.—"Spain Commercially and Economically Considered." By E. M. UNDERDOWN, Esq., Barrister-at-law.

FINAL EXAMINATIONS, 1869.

In order to avoid holding these Examinations on the same evenings as those of the Department of Science and Art, it has been decided to hold them, in 1869, on the evenings of

TUESDAY, the 20th APRIL,
WEDNESDAY, the 21st „
THURSDAY, the 22nd „
FRIDAY, the 23rd „

From 7 p.m. to 10 p.m., instead of on the 27th, 28th, 29th, and 30th April, as announced in the Programme of Examinations for 1869.

In consequence of this alteration the Previous Examinations must be held forthwith, in order that the Forms No. 2 and No. 4, referred to in par. 6 of the Programme, may be sent in in time.

A copy of Form No. 2 has been forwarded to each Local Board, and should be filled up and returned to the Secretary of the Society of Arts immediately.

A sufficient number of applications from candidates in all the subjects referred to in the notice at page 9 of the Programme having been received, papers will be set in Conic Sections, Navigation and Nautical Astronomy, Mining and Metallurgy, and Italian.

Local Boards having candidates either in the "Theory of Music" or in "Elementary Musical Composition (Tonic Sol-fa System)," should communicate with the Secretary of the Society of Arts immediately.

INSTITUTION.

The following Institution has been received into Union since the last announcement:—

London, Albert Working Men's Club, High-road, Knightsbridge, S.W.

COMMITTEE ON INDIA.

This Committee has resolved that Six Conferences be held during the present Session for the discussion of the following subjects, viz.:—

Tea Cultivation in India.
Hill Settlements and Sanitaria.
Waste Lands in India.
Trade with Central Asia, Thibet, and South-Western China.
Indian Fibres.
Silk Cultivation and Supply.

The following evenings have been fixed for holding the conferences:—

Friday, March 12th.
„ April 2nd.
„ April 16th.
„ April 30th.
„ May 14th.
„ May 28th.

At these Meetings the chair will be taken at 8 o'clock, and the discussion will be opened by a paper.

This evening, Friday, March the 12th, Mr. C. H. FIELDER, Hon. Secretary of the India Tea Association, will open the discussion with a paper "On Tea Cultivation in India." The subjects for each subsequent evening will be previously announced in the *Journal.*

Members of the Society interested in Indian questions are invited to attend.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

THAMES EMBANKMENT COMMITTEE.

The Council have appointed a Committee to report upon the best way of dealing with the Thames Embankment, so that the opportunity may not be lost of making this noble site conducive to the embellishment and improvement of the metropolis.

The following gentlemen have been invited to serve on the Committee:—

The Archbishop of York, Vice-Pres. of the Society.
The Duke of Buccleuch, K.G., Vice-Pres. of the Society.
Lord Henry G. Lennox, M.P., Chairman of the Council.
*The Lord De L'Isle and Dudley, Vice-Pres. of the Society.
*Lord Elcho, M.P.
*Baron Meyer de Rothschild.
Rt. Hon. Russell Gurney, Q.C., M.P.
*The Hon. Auberon Herbert.
A. B. Beresford Hope, M.P.
*William Boxall, R.A.
*Sir William Bodkin, Assistant-Judge, Vice-Pres. of the Society.
Montague Chambers, Q.C., M.P.
*Hyde Clarke, Member of the Council.
*Henry Cole, C.B., Vice-Pres. of the Society.
*C. W. Dilke, M.P.
*W. R. Drake, F.S.A.
*Lieut.-Col. Ewart, R.E.

*Alderman Sir T. Gabriel.	Alderman Salomons, M.P.
*W. H. Gregory, M.P.	*Lieut.-Col. Scott, R.E.
Earl Grosvenor, M.P.	*Seymour Teulon, Vice-Chairman of the Council.
Thomas Hughes, M.P.	*Sir Charles Trevelyan, K.C.B.
Sir John Lefevre, K.C.B.	John Walter, M.P.
*John Locke, M.P.	*Richard Westmacott, R.A.
*J. E. Millais, R.A.	*Joseph Whitworth, LL.D.
*S. Redgrave, Vice-Chairman of the Council.	*Watkyn Williams, M.P.
John Ruskin.	

Those gentlemen whose names have an asterisk (*) have already consented to serve on the Committee.

The first meeting of the Committee took place on Tuesday, the 9th inst., at noon. Present—Lord Elcho, M.P., in the chair; Sir Charles Trevelyan, K.C.B., the Hon. Auberon Herbert, Lieut.-Col. C. B. Ewart, R.E., Messrs. Hyde Clarke, Seymour Teulon, Samuel Redgrave, and Richard Westmacott, R.A.

The Committee adjourned till Tuesday next, the 16th inst., at 11 a.m., when it was arranged that the proposal for placing the new Courts of Law upon the Thames Embankment should come under discussion.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 10th, 1869; P. LE NEVE FOSTER, Esq., M.A., Secretary of the Society, in the chair.

The following candidates were proposed for election as members of the Society :—

Airlie and Lintrathen, Earl of, K.T., Airlie-lodge· Campden-hill, W.
Cadogan, Earl, P.C., Chelsea-house, Cadogan-place, S.W., and Nascott-house, Watford.
Collier, Sir Robert P., M.P., Attorney-General, 1, Mitre-court-buildings, Temple, E.C.
Collyer, Colonel George C., R.E., 57, Kensington-gardens-square, W.
Croft, Sir Herbert G. D., Bart., M.P., Oxford and Cambridge Club, S.W.
Cromwell, Rev. J. G., St. Mark's College, Chelsea, S.W.
Denison, Edward, M.P., New University Club, S.W.
Dodds, Joseph, M.P., Reform Club, S.W.
Egerton, Hon. Wilbraham, M.P., 67, Lowndes-sq., S.W.
Exeter, Marquis of, P.C., Engine-court, St. James's-palace, S.W.
Forster, Charles, M.P., 15, Great Queen-street, Westminster, S.W.
Hall, Arthur, 35, Craven-hill-gardens, W.
Henry, J. Snowdon, M.P., 142, The Terrace, Piccadilly, W.
Lancaster, John, M.P., 6, Strand, W.C.
Lusk, Alderman Andrew, M.P., 64, Westbourne-ter., W.
Northbrook, Lord, Stratton-park, Winchester; and Manor-house, Lee, S.E.
Russell, Earl, K.G., F.R.S., 37, Chesham-place, S.W.
Wright, Philip, 3, Kidbrooke-terrace, Blackheath, S.E.

The following candidates were balloted for, and duly elected members of the Society :—

Cluff, William, Grosvenor-house, Hoe-street, Walthamstow, N.E.
Dickins, Thomas, Middleton, near Manchester.
Harriss, J. Fordham, 7, Twickenham-park, Middlesex.
Hewson, Henry, 2, Brighton-villas, Twickenham.
Hogarth, George, The Elms, Foot's Cray, Kent.
Jacomb, Arnold, 70, Jermyn-street, St. James, S.W.
Matthews, James, 26, Wimpole-street, W.
Paice, Bowes A., 9, George-street, Hanover-square, W.
Tulk, John Augustus, Dunster-lodge, Spring-grove, Isleworth, W.
Whitley, John R., Railway Brass Works, Bowman-lane, Leeds.

The Paper read was—

ON MODERN SCREW PROPELLERS PRACTICALLY CONSIDERED.

By N. P. BURGH, Esq.

Author of "Modern Screw Propulsion," &c.

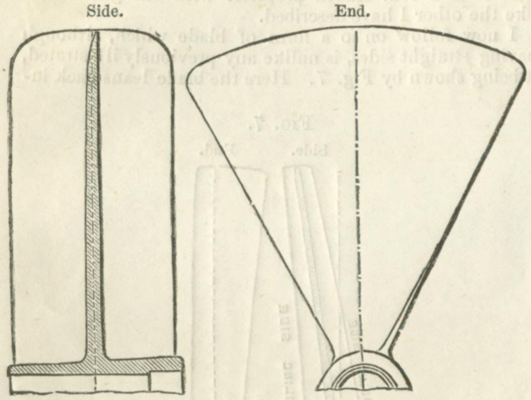
As a prologue to the paper that I shall have the honour of reading to you this evening, permit me to state that the reason why I have chosen the subject of modern screw propellers practically considered, is simply because in nearly all the published matter on that subject the practical portions on which the efficiency of the screw propeller depends have been generally omitted, and consequently the theory is so extravagantly dilated on, that it requires rather hard study to determine which end of the theory is the better to commence with in order to acquire a perception of the whole. The best proof of this conclusion results from the fact, that as within the last few years I have been in constant personal and letter communication with all the leading engineers of England and Scotland, I have found that the unpublished matter I complain of as omitted is really the actual status of their practice, and, indeed, so much so, that I shall this evening lay before you that matter which, excepting in my late work on the subject, has never been published, and I now commence my paper with a description of

THE VARIOUS SHAPES OF MODERN SCREW PROPELLER BLADES.

I need scarcely remind you that a perfect screw is but a band of any material wound completely around a cylinder, and that when the band is unwound, its extremity is the apex of a right-angle triangle, whose height equals the pitch, the length, the circumference, and the hypothenuse, the length of the helix or outside edge, so that the band is in the form of a curved inclined plane or curved wedge, and if any portion of the length is cut off it becomes a portion of a wedge, that is termed the blade of the propeller. Now if we required only one blade to the propeller we should require only one band within the pitch, but if two blades two bands, and if three three bands, and so on, as I shall show you this evening, to six bands or blades or more if desired. When the shape of the blade is a whole portion of a true screw, its outline is two apexed angles joined by an arc, whose radius is that of the screw's diameter. But when the blade is cut and carved to suit the eye and mind of the designer, then the artificial shape takes the place of the natural form, but with what result will appear further on. I have, therefore, endeavoured to explain to you what the principles are, and I will now proceed with the description of the practice.

A very good example of a common screw blade is illustrated by Fig. 1. These are the side and end elevations as they actually appear to the eye from the two positions; the side view has a portion of the boss and the blade in section; it shows also that the shape of the outline is a parallelogram, and the end view depicts the two angles joined by the arc, forming the helix or top edge of the blade. As the corners of the extremities are cut off or rounded in this view, they are curved in the other also, instead of the sharp connections of the arcs, and angles, and vertical lines, which would appear were the blade to be a portion of a perfect screw. The propeller to which this blade belongs is 16 ft. in diameter, and 20 ft. pitch, and the chord of the arc of the helix, or maximum width of the blade, is 8 ft., and the length on the line of the keel 3 ft. 4 in.; it was constructed by Messrs. James Watt and Co., and fitted by them to H.M.T.S. *Simoom*.

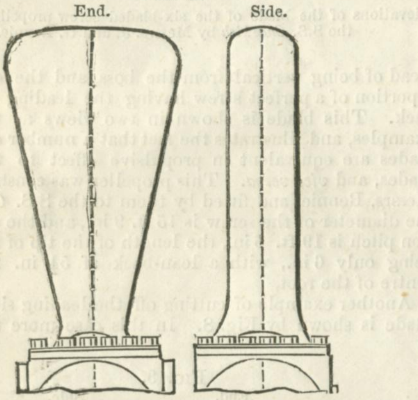
Fig. 1.



Elevations of the blade of the common two-bladed screw propeller fitted to H.M.T.S. *Simoom* by Messrs. James Watt and Co.

The next example of the common type is one of a four-bladed propeller, and is illustrated by Fig. 2. Here we

Fig. 2.

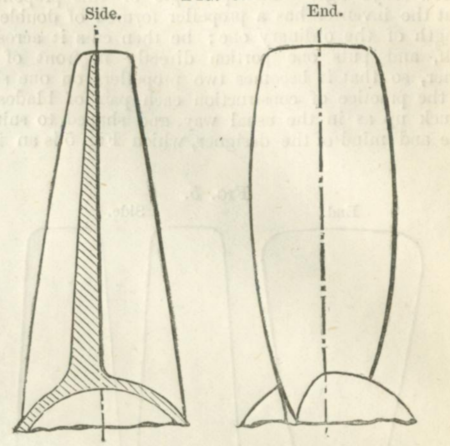


Elevations of the blade of the four bladed screw propeller fitted to H.M.S.A.P.S. *Minotaur* by Messrs. J. Penn and Son.

have the same form of outline as before, and very nearly the same proportion in the two views. This class has lately found its way into the Royal Navy by some means or other, for Messrs. Penn, Maudslay, and Raven-hill, have fitted four-bladed propellers to the *Minotaur*, diameter 24 ft.; to the *Agincourt*, diameter, 24 ft. 6 in.; to the *Lord Clyde*, diameter 23 ft. Those blades are not portions of a perfect screw of a uniform pitch, but of two screws of unequal pitches, and the centre of the blade is the point of their connection, thus:—The blades of the *Minotaur's* screw are constructed 25 ft. forward pitch, and aft 28 ft.; the *Agincourt's*, 24 ft. 10½ in. and 28 ft. 1½ in.; and the *Lord Clyde's*, 23·45 ft. and 26·55 ft. Messrs. Penn have also fitted the *Achilles* with a four-bladed propeller of the class under notice; its diameter is 24 ft. 6 in. pitch, 25 ft. aft and 28 ft. forward. Messrs. Maudslay have fitted a similar example to the *Lord Warden*, 23 ft. in diameter. I may add, in passing, that the *Agincourt's* propeller blade is a complete portion of a screw, for the corners are not rounded off, as with the examples shown in the illustration Fig 2.

The next shape of blade that I introduce to your notice is shown by Fig. 3. On contrasting its outline with that of Figs. 1 and 2, you will observe that the end elevation is narrower at the top than below; and that the sides are curved instead of angular lines, and the width at the root of the blade, or its connection with the boss, is but very

Fig. 3.

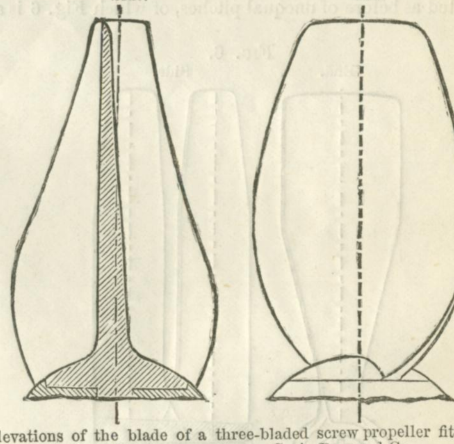


Elevations of the blade of the four-bladed screw propeller fitted to the S.S. *Allemannia* by Messrs. C. A. Day and Co.

little less than at the extremity. Viewing next the side elevation, the contrast is greater, for here the top width of the blade is the narrower, and the root the wider, instead of the sides being parallel; this, then, is the result of "cutting" and "carving," inasmuch that were these blades perfect portions of a screw, their appearance would be as those I have before described. The vertical section is given in the side view, which depicts the blade as straight from the root to the tip. This propeller was fitted to the S.S. *Allemania* by Messrs. C. A. Day and Co.

Another example, having three blades only, has been constructed by the same firm, and fitted to the S.S. *Surat*. One of the blades is shown by Fig. 4, which gives

Fig. 4.



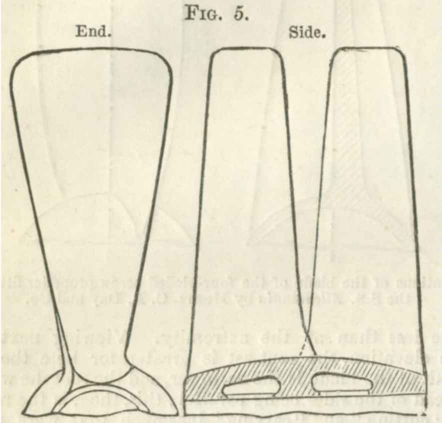
Elevations of the blade of a three-bladed screw propeller fitted to the S.S. *Surat* by Messrs. C. A. Day and Co.

an end and side view of it. Here it will be seen in the end view that the blade is wider, proportionately, than in Fig. 3, and therefore the sides are curved more than the other; excepting that difference the blades are identical.

I now direct your attention to a pair of double-bladed screw propeller blades, which, according to the general belief, were originated by a French gentleman named M. Mangin, from whom emanated the now well-known "Mangin" screw-propeller; and I may as well tell you that Messrs. Rennie were the first to entertain the idea in England, and the model of the first English screw of the kind was put into my hands by Mr. G. Rennie

a few days ago. The principle of this propeller is that the inventor has a propeller formed of double the length of the ordinary one; he then cuts it across in half, and puts one portion directly in front of the other, so that it becomes two propellers on one shaft. In the practice of construction each pair of blades are struck up as in the usual way, and shaped to suit the eye and mind of the designer, which Fig. 5 is an illus-

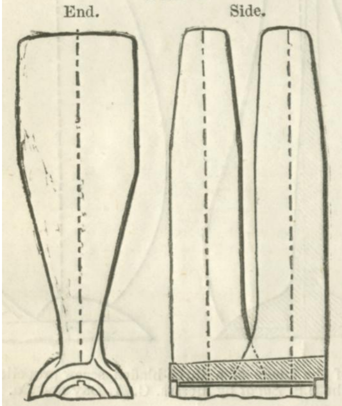
Fig. 5.



Elevations of the blades of a twin-double-bladed screw propeller fitted to H.M.S. *Bullfinch* by Messrs. J. and G. Rennie.

tration of. In this case the sides are angular reversely in each view, the end elevation showing the blade widest at the top and narrowest in the side elevation. This propeller was constructed by Messrs. Rennie; its diameter is 7 feet 3 inches, pitch 11 feet 4 inches, and the maximum width 1 foot 8 inches, being fitted by them to H.M.S. *Bullfinch*. The inventor, M. Mangin, not being content with double blades of a uniform pitch, advocates blades situated as before of unequal pitches, of which Fig. 6 is an

Fig. 6.

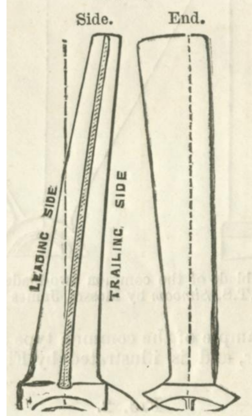


Elevations of the blades of the twin-double-bladed screw propeller fitted to H.M.S. *Favourite* by Messrs. Humphrys, Tennant, and Co.

illustration. Each blade is formed from two helices that are connected at one-fourth of the full width, starting at the leading edge; the forward pitch is 16 feet 8 inches, and the aft 20 feet, the diameter of the screw is 16 feet, and the maximum width of each blade 2 ft. 8 in. The outline is peculiar, as in each view the sides are angular and vertical reversely situated. Messrs. Humphrys, Tennant, and Co., constructed this propeller and fitted it to H.M.S. *Favourite*. Of course it must be understood that it is a four-bladed propeller with straight blades like the other I have described.

I now follow on to a form of blade which, although having straight sides, is unlike any previously illustrated, it being shown by Fig. 7. Here the blade leans back in-

Fig. 7.

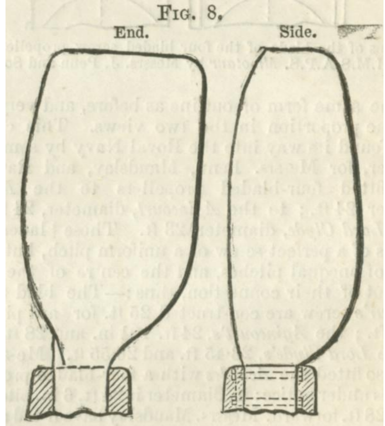


Elevations of the blade of the six-bladed screw propeller fitted to the S.S. *Charkieh* by Messrs. J. and G. Rennie.

stead of being vertical from the boss, and the outline is a portion of a perfect screw having the leading side cut back. This blade is shown in two views as the other examples, and illustrates the fact that a number of narrow blades are equivalent in propulsive effect to two wide blades, and *vice versa*. This propeller was constructed by Messrs. Rennie, and fitted by them to the S.S. *Charkieh*; the diameter of the screw is 15 ft. 9 in., and the construction pitch is 19 ft. 6 in., the length of the tip of the blade being only 6 in., with a lean-back of 5½ in. from the centre of the root.

Another example of cutting off the leading side of the blade is shown by Fig. 8. In this case more than one-

Fig. 8.



Elevations of the blade of the feathering two-bladed screw propeller fitted to H.M.S. *Aurora* by Messrs. Maudslay, Sons, and Field.

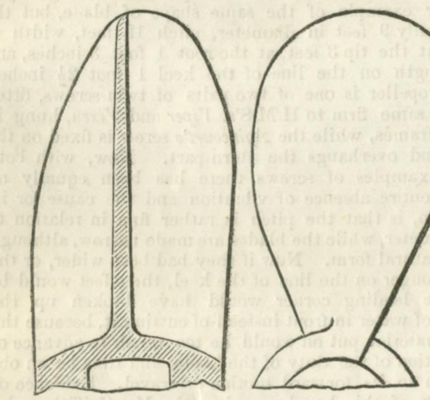
half of the perfect blade is taken away, as shown in the two views, so that a plan of the blade shows that the forward part of the helix is stopped off at a certain distance from the centre of the boss for a little less than half of the width of the aft portion of the blade or helix. The vertical section of the blade is perpendicular, and the sides nearly straight; the propeller is 17 feet in diameter, and the construction pitch 20 feet, the maximum width

of the blade being 4 feet. It was constructed by Messrs. Maudslay, Sons, and Field, and fitted by them to H.M.S. *Aurora*.

The ideas of Messrs. Dudgeon as to the best form of blade contrast extremely with those of Messrs. Maudslay, as shown by Fig. 9. The sides of the blade for half their

FIG. 9.

Side. End.



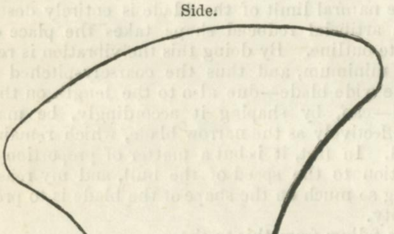
Elevations of the blade of the three-bladed common screw propeller fitted to the S.S. *Ruahine* by Messrs. J. and W. Dudgeon.

vertical length are portions of a perfect helix, but above that the cutting and carving commences, the tip is rounded aft and forward to a great extent—indeed, so much so that the natural outline of the top edge is entirely made away with. You will readily see this from the two views I have given. This propeller is 10 feet 6 inches in diameter, 18 feet pitch, and the maximum width of the blade is 4 feet 3 inches.

Now, this is an example of the modern form of blade for three and four-bladed common screw-propellers, and although of late construction, is of early adoption. I prove this fact to you by Fig. 10, which is the side

FIG. 10.

Side.



Side elevation of the four-bladed propeller fitted to H.M.S. *Dwarf* by the late G. Rennie, Esq.

elevation of the original four-bladed screw-propeller, fitted by the late G. Rennie, Esq., to H.M.S. *Dwarf* many years ago, or rather at the eve of screw propulsion. This blade is cut away so much that its natural outline is taken off entirely, which shows that the "cutting" and "carving" commenced with the use of the screw for propulsion.

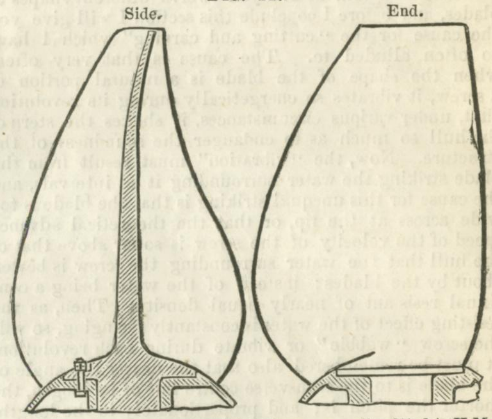
I next introduce to your notice another form of blade for screw propellers, invented and patented by my friend, Mr. Robert Griffiths. That gentleman has investigated this portion of the system thoroughly; he has written for me an article on it, and in one place he states, "I directed my attention to experiments with a view to ascertain what portion of the blade was the most effective. My first experiment with this object was to reverse the shape of the blades by putting the narrow parts to the outside, and the wide parts inside, or from and towards the centre of the disc—indeed, just the contrary to what was the usual practice, and I soon found I attained a better result with the blades formed in this manner than with any other." Mr. Griffiths treats on the vertical section of the blade also. He states, "I also find great advantage in constructing my screw-propeller blades to incline forward, the curve commencing from the centre of the length of the blade and extending to its point towards the ship, which result of advantage I account for in the following manner: when the ship is under 'way,' the screw is supplied with water from the after current, and this current has to be turned from its natural course, which is to fill up the space or channel that the ship has left, and also to supply the screw with propelling resistance, so that when the points of the blades bend towards the ship, they meet this current, and offer certain resistance to the power employed to work the screw, or what may be termed a greater bite to propel the ship."

It would appear from this statement that the straight blades must lose some power, or slip through the water instead of pressing full against it; yet in the face of this argument we find in practice that there is no disproportionate loss with either form of section.

The form of the Griffiths' blade will be understood from the illustration of it, Fig. 11. It will be noticed that the side

FIG. 11.

Side. End.

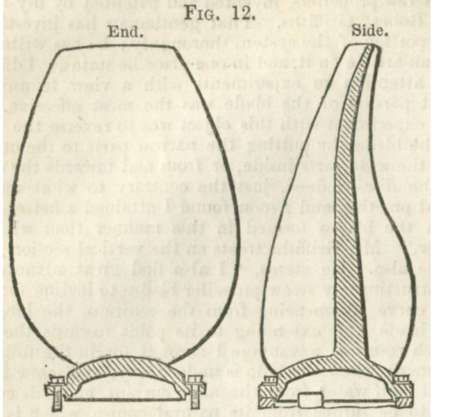


Elevations of the two-blade Griffiths' screw propeller fitted to H.M.S. *Arethusa* by Messrs. J. Penn and Son.

elevation shows that the vertical section is curved forward at the upper part, and the forward side is curved outwards over the boss, and above that it is curved inwards, while the aft side is a continuous curve in one direction from the root to the tip. The end elevation shows that the leading side is cut away more than that opposite.

The most modern practice of the principal firms is to make the leading and following sides of the blade alike, as shown by Fig. 12, which is an illustration of one of the two blades of the propeller constructed for H.M.S. *Lord Warden* by Messrs. Maudslay, Sons, and Field. The pitch of the screw is 23 feet 6 inches, its diameter 23 feet, and the maximum width of the blade 7 feet 4½ inches; at the tip 3 feet 2⅝ inches, and at the root 3 feet 3 inches. The *Lord Clyde*, also an armour-plated ship in the Royal Navy, was originally fitted with a Griffiths' two-bladed propeller—diameter, 23 feet; pitch, 23 feet 6 inches;

FIG. 12.



Elevations of a two-bladed Griffiths' screw propeller constructed for H.M.S. *Lord Warden* by Messrs. Maudslay, Sons, and Field.

maximum width of the blade, 7 feet; at the tip, 3 feet 3 inches; and at the root, 4 feet 4 inches—as constructed by Messrs. Ravenhill and Hodgson. I may add, in passing, that the screw of the example, Fig. 11, is 18 feet in diameter, and 23 feet pitch; maximum width of the blade 6 feet, at the tip 2 feet 7 inches, and at the root, 3 feet 9 inches, from which you see that all the matters agree pretty closely as to the proportions. The amount of curve forward of the blade, or "lean-to," is thus: that by Messrs. Penn is 9 inches from the aft side to the forward edge, that by Messrs. Maudslay $12\frac{1}{2}$ inches, and that by Messrs. Ravenhill $12\frac{3}{16}$ inches.

I have now laid before you twelve different shapes of blades, and before I conclude this section I will give you the cause for the "cutting and carving" which I have so often alluded to. The cause is that very often, when the shape of the blade is a natural portion of a screw, it vibrates so energetically during its revolution that, under various circumstances, it shakes the stern of the hull so much as to endanger the soundness of the structure. Now, the "vibration" must result from the blade striking the water surrounding it at intervals, and the cause for this unequal striking is that the blade is too wide across at the tip, or that the theoretical advance speed of the velocity of the screw is so far above that of the hull that the water surrounding the screw is beaten about by the blades; instead of the water being a continual resistant of nearly equal density. Then, as the resisting effect of the water is constantly changing, so will the screw "wabble" or vibrate during each revolution. It must be remembered also that the nearer the angle of the blade is to the transverse centre line of its length, the shorter the pitch is; and proportionately to the length, the wider the blade will be, so that when three or four or six narrow blades are used, the pitch must be greater in proportion to the number of the blades and diameter of the screw used than for two-bladed screws.

The theoretical action of the blade in the water is as a carpentry screw entering a piece of wood, *i.e.*, no slip or lateral commotion, but the practical action is far from that, inasmuch as there is some slip, and often lateral commotion too. The aim, then, of the designer, when cutting away the natural outline of the blade, is to make the leading side and edge curved, so that it will slice the water and not bruise it, and thus cause the least disturbance during its motion; of course, on the screw starting, the blades will strike the water sideways under all circumstances, and this "side-striking" is only reduced to the minimum when the shape of the blade, velocity, and pitch of the screw agree with the speed of the hull. I may as well observe, also, that the cutting away of the leading corner of the blade is not universal, for Messrs. Maudslay have generally constructed their common screw blades of the perfect shape; or as the helix and length on the line of the keel determine. The screw propeller 24 feet 6 inches in diameter, with four blades, fitted by them to H.M.S. *Agincourt*, is the perfect-shaped blade; its width at the tip is 5 feet 5 inches, and at the root 3 feet, the side being angular but perfectly straight; the construction pitch of the screw is so fine that the length of the blade on the line of the keel is only 1 foot 9 inches when it is set at 24 feet pitch. I will give you another example of the same shape of blade, but the screw only 9 feet in diameter, pitch 12 feet, width of blade at the tip 3 feet, at the root 1 foot 3 inches, and the length on the line of the keel 1 foot $2\frac{1}{2}$ inches. This propeller is one of two pairs of twin-screws, fitted by the same firm to H.M.S's. *Viper* and *Vixen*, hung in lifting frames, while the *Agincourt's* screw is fixed on the shaft, and overhangs the stern-part. Now, with both these examples of screws there has been equally an almost entire absence of vibration and the cause for its obviation, is that the pitch is rather fine in relation to the diameter, while the blades are made narrow, although of the natural form. Now if they had been wider, or the screws longer on the line of the keel, the effect would be that the leading corner would have broken up the current of water in front instead of cutting it, because the extra material put on would be too much in advance of the position of the duty of the blade, and thus be an obstruction to its forward motion or travel. Evidence of the truth of this has been given by Mr. Griffiths, who has written for me the description of the following fact:—"When I first commenced applying my screw propellers, I put one on a vessel that was in dock, and I then dropped spots of candle-grease all over the blades of the propellers on both sides, and after some time, on the return of the ship to dock to alter the pitch of the screw, I found that the tallow had been worn off by the friction of the water on the propelling side of the front surface, just across the middle or widest part, and on the forward side of the leading edge of the back surface." That, I think, you will allow was surely a simple as well as a sure means of knowing where the friction or resistance was the greatest, both on the fore and aft surfaces of the blade, and proved, too, that the leading corners in that instance had better have been cut away. So far is this certain that when the blades are wide, as in fig. 9, the leading and following corners are rounded excessively; indeed, so much so that the natural limit of the blade is entirely destroyed, and an artificial reduced shape takes the place of the complete outline. By doing this the vibration is reduced to the minimum, and thus the coarsely-pitched screw with the wide blade—due also to the length on the line of keel—can, by shaping it accordingly, be made to act as effectively as the narrow blade, which remains untouched. In fact, it is but a matter of proportion *in toto* in relation to the speed of the hull, and my reason for dwelling so much on the shape of the blade is to prove its simplicity.

I now follow from this to the—

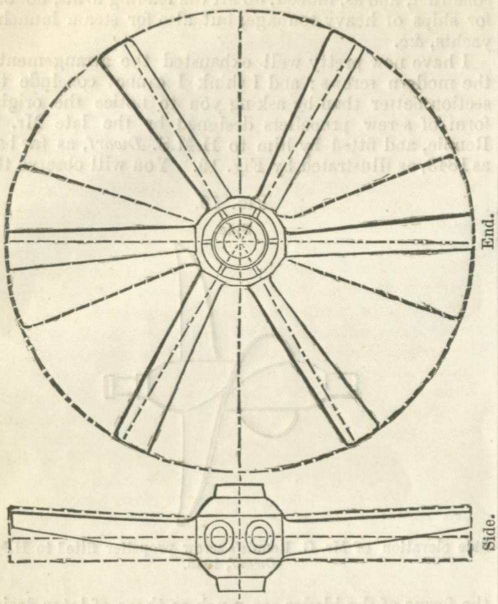
General Arrangement of Modern Screw Propellers.

I commence this section with a description of the six-bladed screw-propeller, constructed by Messrs. Rennie, and illustrated by fig. 13. You will notice that the blades are inclined back in both views, and that they are almost perfect parallelograms in outline, so that the rounding off of the leading corners is not carried out at all in this case.

As a contrast, I have drawn in dotted lines a two-bladed screw also, whose area of blade surface equals that of the original, by which you can see that a very little width and length comparatively only is required to make the surface of a two-bladed screw to equal that having six blades of a shorter length, but of the same pitch.

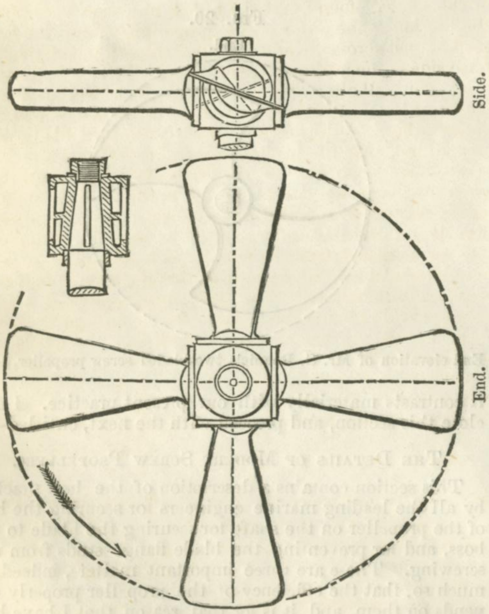
Next I illustrate, by fig. 14, a four-bladed screw, as used in the Royal Navy at present. The corners, you will observe, are but very slightly curved, so slightly that the natural outline is nearly preserved. As the shape of the

FIG. 13.



Elevations of a six-bladed propeller fitted to ships in the Egyptian Royal Navy by Messrs. Rennie, 1867. Diameter, 15ft. 9in.; pitch (adjustable), 17ft. 6in. to 21ft. 6in.; mean pitch, 19ft.; length on the line of the keel at root, 1ft. 2in.; at tip, 6in.

FIG. 14.

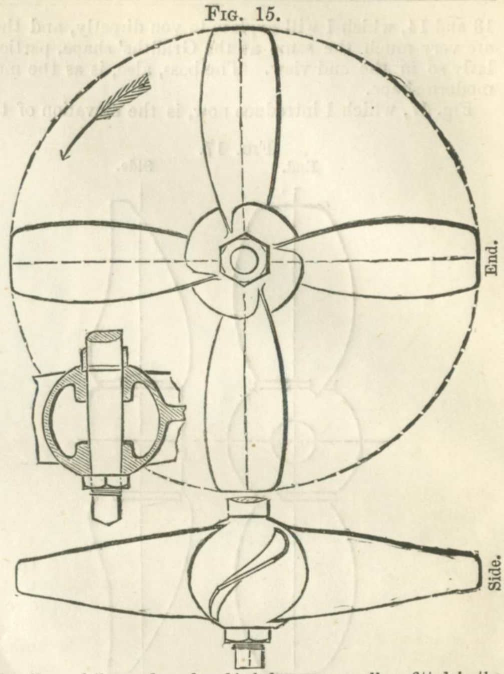


Elevations of the modern four-bladed screw propeller as fitted in the Royal Navy by Messrs. J. Penn and Son, 1869. Diameter, 24ft.; pitch, leading side, 24ft.; pitch, following side, 27ft; adjustable pitches, 23ft. to 28ft; mean pitch, 25ft. 6in.; length on the line of the keel, 2ft.

boss appears square, I have given a sectional plan of it, which shows also how it is secured on the shaft, being by a longitudinal key and a nut at the end. There are other methods, however, in practice, to which I shall presently refer.

The next example that I have deemed worthy of your attention is illustrated by Fig. 15. Here you will notice

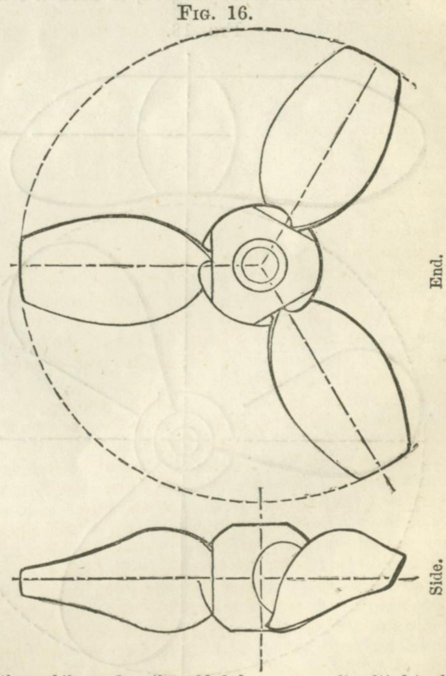
FIG. 15.



Elevations of the modern four-bladed screw propellers fitted in the merchant navy by Messrs. C. A. Day and Co., 1868. Diameter, 16ft.; pitch, 25ft.; length on line of the keel, 3ft. root, 1ft. tip.

that the blade is merely the Griffiths' shape, minus the lean-to or curve forward. The boss is spherical, as shown in the complete views and the sectional plan. This propeller has lately been constructed by Messrs. C. A. Day and Co., as also has the three-bladed example shown by fig. 16. The blades in this case are adjustable, as in figs.

FIG. 16.

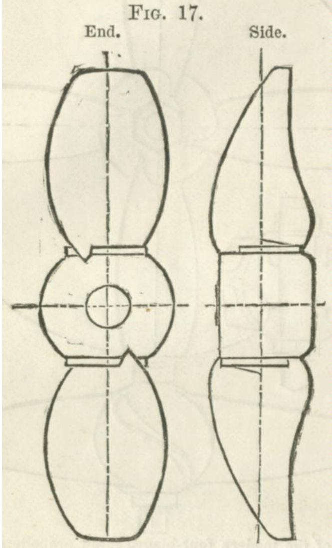


Elevations of the modern three-bladed screw propeller fitted to ships of the P. and O. Company by Messrs. C. A. Day and Co., 1868. Diameter 18ft; pitch (adjustable), 22ft. to 27ft.; pitch (mean), 24ft. 6in.; length on the line of the keel over boss, 4ft. 2in.; tip, 1ft.

13 and 14, which I will explain to you directly, and they are very much the same as the Griffiths' shape, particularly so in the end view. The boss, also, is as the most modern shape.

Fig. 17, which I introduce now, is the elevation of the

Fig. 17.

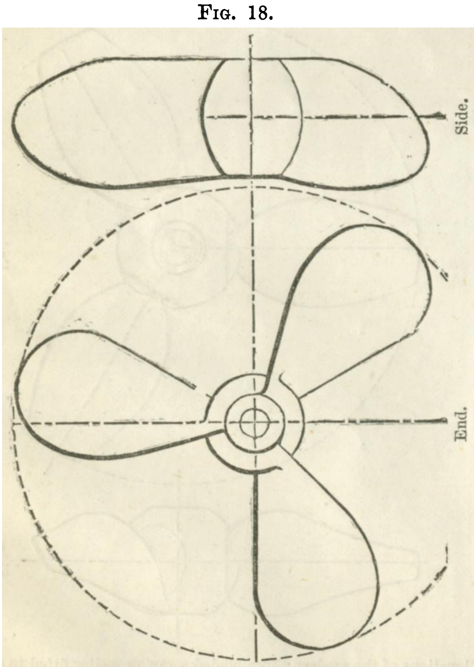


Elevations of the modern two-bladed Griffiths' screw propellers as fitted in the Royal Navy by the leading marine engineers, 1869. Diameter, 23ft; pitches (adjustable), 21ft. to 26ft.; mean pitch, 23ft. 6in.; lean-to, 11¼in.; length on the line of the keel over boss, 6ft. 6in.; at tip, 1ft. 3in.

modern two-bladed Griffiths' screw-propeller with adjustable blades, and the boss shaped as the frustum of a sphere.

The next example is the latest three-bladed common screw propeller, illustrated by Fig. 18, as Messrs. Dudgeon

Fig. 18.

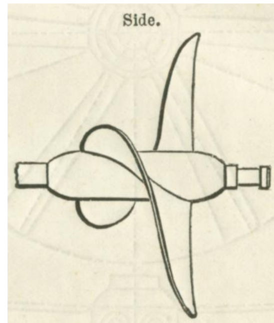


Elevations of the three-bladed screw propeller fitted to ships in the merchant navy by Messrs. Dudgeon, 1867. Diameter, 10ft. 6in.; pitch, 18ft; length on the line of the keel, 2ft.

construct, and as, indeed, do all the leading firms, not only for ships of heavy tonnage, but also for steam launches, yachts, &c.

I have now pretty well exhausted the arrangement of the modern screws; and I think I cannot conclude this section better than by asking you to notice the original form of screw propellers designed by the late Mr. G. Rennie, and fitted by him to H.M.S. *Dwarf*, as far back as 1843, as illustrated by Fig. 19. You will observe that

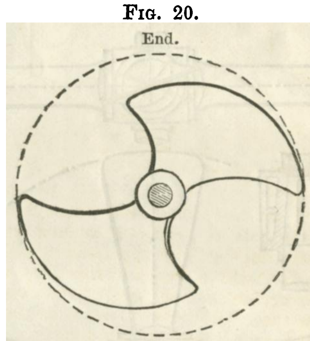
Fig. 19.



Side elevation of Mr. G. Rennie's screw propeller fitted to H.M.S. *Dwarf*, 1843.

the forms of the blades are much as those of later design, and, excepting the spiral portion in front, it might be termed a modern two-bladed screw. Another form of two-bladed screw was designed and fitted to the *Dwarf* by Mr. Rennie, which I have illustrated by Fig. 20, and

Fig. 20.



End elevation of Mr. G. Rennie's two-bladed screw propeller, 1844.

it contrasts materially with our present practice. I now close this section, and proceed with the next, entitled—

The Details of Modern Screw Propellers.

This section contains a description of the best practice by all the leading marine engineers for securing the boss of the propeller on the shaft, for securing the blade to the boss, and for preventing the blade flange studs from unscrewing. These are three important matters, indeed, so much so, that the efficiency of the propeller properly depends on them, and it is for that reason that I have laid before you these subjects in as practical a manner as the manufacturers put them forth for actual construction. First, then, for the best methods for—

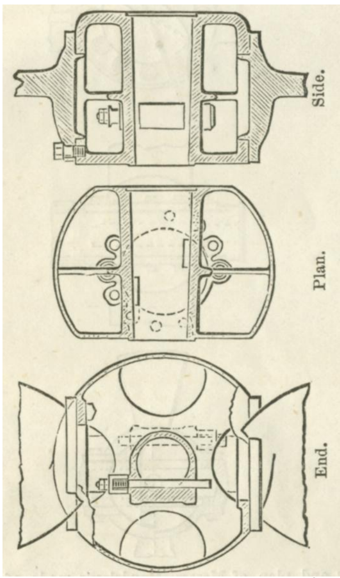
Securing the Boss on the Shaft.

Messrs. Penn's practice is shown by Fig. 14 in the previous section; they taper the shaft within the boss considerably. Thus, in the case of the *Minotaur's* screw, the shaft's diameter at the forward end of the boss is 1 ft. 11 in., but at the aft end it is 1 ft. 2 in., the length of the taper being 3 ft. 9 in.; the end of the shaft is screwed 13 in.

in diameter, and a nut acting against a washer, between it and the boss, maintains the resistance from the aft thrust. To prevent the screw from turning separately, or being loose on the shaft, two longitudinal keys, oppositely situated, each 3 inches wide, are driven in between grooves twinly formed in the boss and shaft. This is, I may term, a very healthy method, as it constitutes a good sound resistance to the wear and tear which the connection of the boss with the shaft is subject to.

Another means to maintain the same effect is used by Messrs. Ravenhill and Hodgson. I have illustrated this by Fig. 21. You will notice that in this case the shaft

FIG. 21.

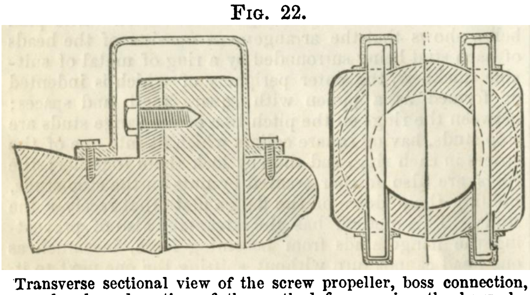


Sectional elevations and plan of the boss of a modern Griffiths' screw propeller, also showing the method of securing the boss on the shaft and the blades to the boss. By Messrs. Ravenhill and Hodgson.

is secured by keys only, but these keys are situated laterally, in relation to the shaft and boss, on each side of the diameter of the taper, and fore and aft of its length. You will understand this best when I explain that two segments are cut out of the circle of the shaft; into these spaces the keys fit, and thus the boss is fixed on the shaft laterally and longitudinally. To prevent the keys withdrawing, they are fitted at the smaller ends with double nuts, which can be used to tighten them also if required.

Messrs. Maudslay's practice I have illustrated by Fig. 22. I have shown a transverse sectional view of the boss

FIG. 22.



Transverse sectional view of the screw propeller, boss connection, and enlarged section of the method for securing the keys, by Messrs. Maudslay, Sons, and Field.

connection with the shaft, by which you will see that they adopt two lateral keys also, but their method of securing them is entirely different from Messrs. Ravenhill's practice. In this case the keys are held by side pieces that are secured against the keys by studs; as shown in detail on an enlarged scale in this illustration also.

As these two latter examples belong to propellers of equal proportions, but constructed by two firms, it may interest you to know how far the makers have taken similar views as to the main dimensions; and I may as well tell you that the *Lord Clyde* and *Lord Warden* are the hulls to which the propellers are fitted. Both propellers are the double-bladed Griffiths' types, made according to all the modern improvements. I here give the main dimensions:—

Proportions of the boss and shaft connection of the Propeller fitted by Messrs. Ravenhill to the "Lord Clyde."

	ft.	in.
Length of taper in boss	4	5½
Diameter of shaft (forward end)	1	9⅞
,, ,, (aft end)	1	6½
Width of key	0	10
Thickness of key	0	3
Longitudinal space between keys........	0	4

Proportions of the boss and shaft connection of the Propeller fitted by Messrs. Maudslay to the "Lord Warden."

	ft.	in.
Length of taper in boss	4	0
Diameter of shaft (forward end)	1	9
,, ,, (aft end)	1	5
Width of key	0	8½
Thickness of key	0	3
Longitudinal space between keys........	0	6

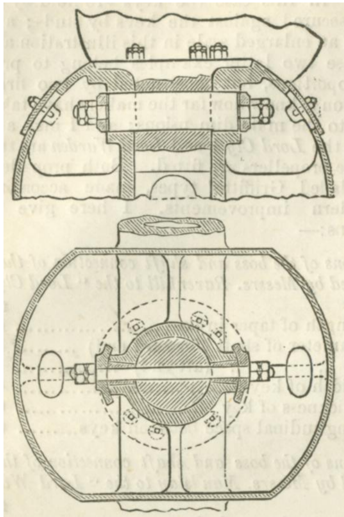
Besides the methods I have explained, many makers secure the propeller with one lateral key only, passing through the boss and shaft, and others with the key behind the boss, so that nearly all the mechanical modes have been adopted and tried. But the main practical question in this matter is—How to get the boss from the shaft? It is all very well to be able to key it on tightly, but a time will come when it must be made loose again to take it off, and it is for that reason that the lateral keys at the sides of the shaft have been adopted, for they can be easily removed, and thus the boss driven off, or the shaft withdrawn; or, as Messrs. Penn prefer, the taper is great, and thus, when the nut is withdrawn, the disconnection is easier. I now follow on to the description of the modern practice of

SECURING THE BLADES TO THE BOSS, COMBINED WITH PREVENTING THE FLANGE STUDS FROM UNSCREWING.

You are of course aware that when the blades and the boss are in one casting, all the details I have now to describe are useless, but as we live in the days of gigantic means of warfare, so do we require gigantic propellers, and as those are costly as well as heavy, in the event of the fracture of any portion of them it is far better to replace the detail than the whole. But apart from that it has been deemed more advantageous to be able to adjust the angle of the blades to suit the velocity of the screw and speed of the hull, than to have a fixed angle which if altered required a new propeller.

When Mr. Griffiths started his propeller he made the blades fixed on the boss, but he soon discarded that practice, for in the article he has written for me, he states, "My attention was next directed to the construction of my screw-propeller in such a way as would combine the greatest possible stability with increased facilities for altering the pitch or replacing a broken blade in case of an accident," and the illustration, Fig. 23, represents his mode of carrying out his requirements. This is the "key and wedges" arrangement, the "key" passing through the securing portion of the blade, and the metal in the boss surrounding it. The "wedges" are arranged in the key spaces in the boss, so as to alter the angle of the key and blade simultaneously. To prevent the keys and wedges from shifting when set, stop plates and screw

Fig. 23.

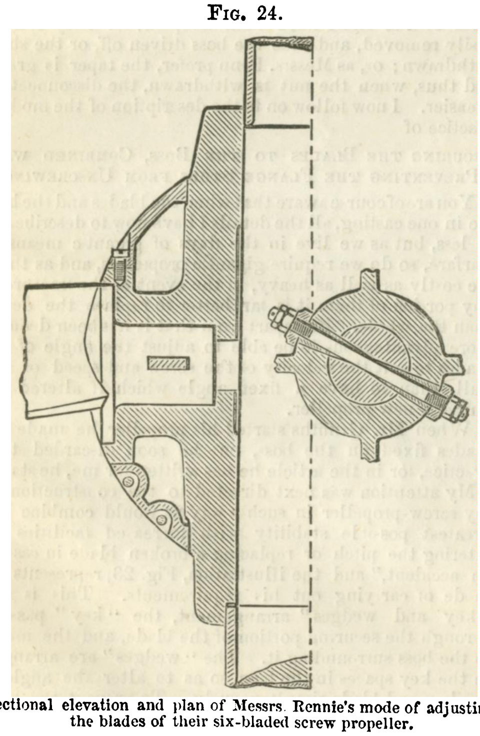


Sectional plan and elevation of Mr. Griffiths' mode of securing and adjusting the blades of screw propeller.

nuts are put on the extremities of the keys. This means has since been continually adopted with the addition of securing studs, as shown in the sectional elevation.

Now the adoption of the set or securing studs led to the non-adoption of the keys aud wedges, *i.e.*, what was introduced as an assistant became the master entirely, and, therefore, the simple flange and stud connection was introduced, which is now almost universal. Some firms, however, have lately used the original mode; for example, Messrs. Rennie, with their modern six-bladed propeller, prefer to adjust the blades, as illustrated by Fig. 24,

Fig. 24.

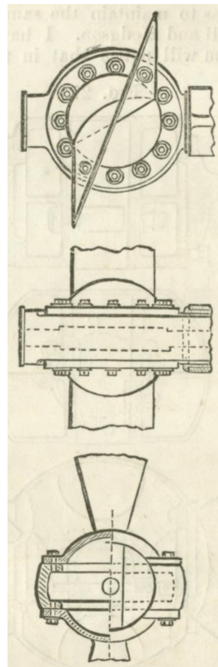


Sectional elevation and plan of Messrs. Rennie's mode of adjusting the blades of their six-bladed screw propeller.

which is the key and wedge arrangement without the securing studs and nuts.

I must not forget, however, to mention that Messrs. Maudslay have always preferred to omit the keys and wedges, and use the studs and flange only, which I illustrate an example of by Fig. 25. This is a flat boss,

Fig. 25.



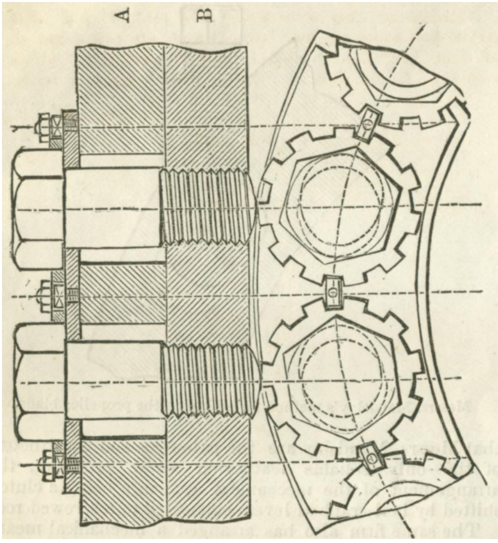
Elevations and plan of Messrs. Maudslay's mode of securing the blades of the propellers fitted to H.M.S. *Viper* and *Vixen.*

to which is secured the blades by studs screwed into flanges, and the complete outline forms a singular comparison with that in Figs. 21 and 23.

The reason why the studs and flanges are sufficient to secure the blades, is that the surfaces of the flange of the blade form a perfect point, and when thus connected the frictional contact is almost unlimited, so much so, indeed, that it is a rare occurrence for the largest and longest blades to shift round on their seats after being screwed down by the set studs.

I proceed now to describe the various methods for preventing the flange studs from unscrewing, commencing with Messrs. Penn's latest improvement, which I have illustrated in two views by Fig. 26. A is the flange of the blade, and B is the flange of the boss. The plan below shows that the arrangement consists of the heads of each stud being surrounded by a ring of metal of suitable thickness, the outer periphery of which is indented or formed as a pinion with square teeth and spaces; between the rings on the pitch line of the flange studs are stop-studs, having square collars which fit into one of the spaces in each ring, and thereby lock them together; the rings are also further secured by nuts on the stop-studs, holding them down on the flange plate that receives the studs. This method has the advantage also of preventing the flange studs from becoming loose, inasmuch as one head cannot turn without shifting the one next to it, and so on in succession. It will be noticed also that as each ring has eleven spaces on its outer edge, there are, therefore, eleven separate angles to which the main studs can be screwed up to for securing the flange of the blade to the boss.

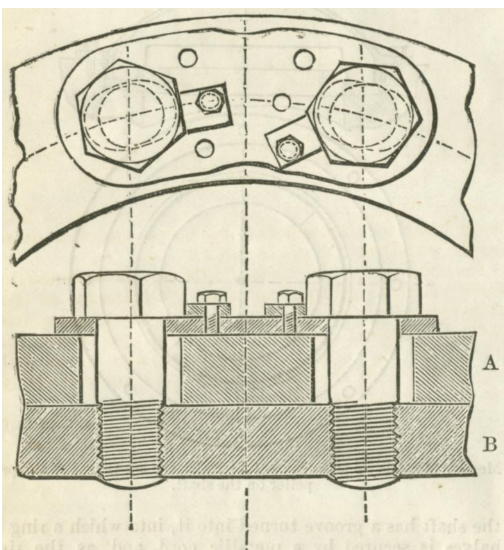
FIG. 26.



Messrs. Penn's method for securing the heads of screw-propeller flange-studs.

Messrs. Maudslays' mechanical arrangement in this matter is illustrated by Fig. 27. A is the blade flange,

FIG. 27.

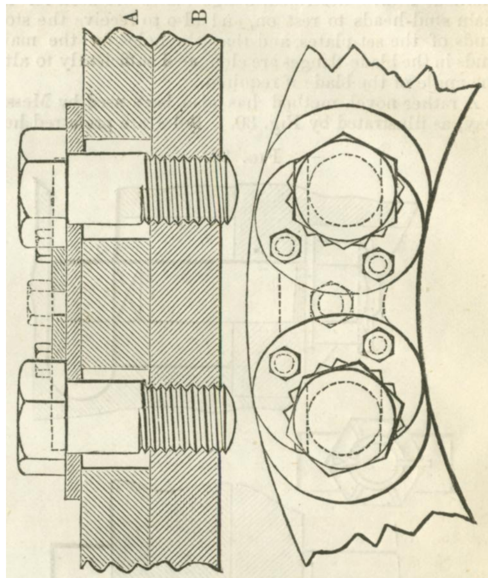


Messrs. Maudslay's method for securing the heads of screw-propeller flange-studs.

and B the boss; above this is the plan, which shows that each pair of studs are fitted with a flange plate, on which the head is fixed, and to secure the head from turning round the set-plate is used, the edge of which fits against any side of the head. This plate can be secured at three separate points by the same stud, and as the plate has four sides all un-equidistant from the centre of the stud, there are of course twelve angles in this case, to which the main studs can be screwed up to for securing the flange of the blade. This method is the cheapest possible, and equally as certain as the previous arrangement, but without the combined locking of the heads.

Messrs. Maudslay have used the arrangement shown by Fig. 28 also. Here A and B refer to the two flanges as

FIG. 28.

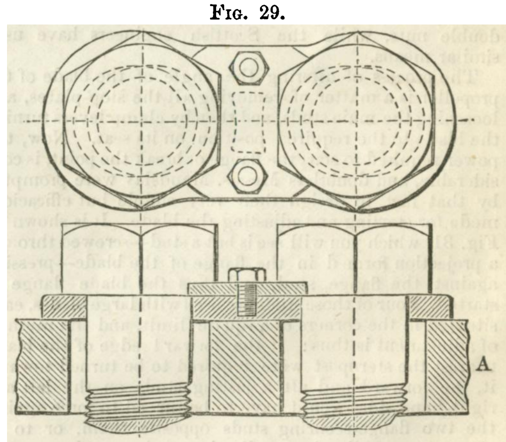


Messrs. Maudslay's method for securing the heads of screw-propeller flange-studs.

before, and the plan shows that the heads of the main-studs are held in position by separate plates of a curved form, the inside edge being indented angularly to fit the hexagonal edges of the stud, and the line of the depth of the indentations is a curve whose radius equals half the width of the head across the angles; each plate is secured by two studs, and as there are eleven indents, so can the heads be secured at eleven different angles; the firm sometimes prefers to connect each pair of main stud heads by a single stop-plate secured by one stud, its extremities being as the single plate, the middle portion and the stud being shown by dotted lines in the plan and section of the above illustration.

Messrs. Ravenhill's practice must next be noticed. This firm prefers the appliance shown by Fig. 29, which consists

FIG. 29.



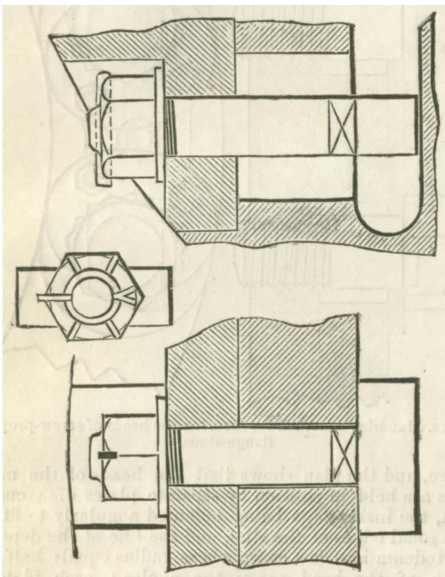
Messrs. Ravenhill's method for securing the heads of screw-propeller flange-studs.

of a stop-plate situated between each pair of main stud-heads; in this illustration the plate fits the flats of the

heads, but other forms of plates are used also, very much as the double plate by Messrs. Maudslay, just referred to. You will, of course, have noticed that with the four methods I have described, flange plates are used for the main stud-heads to rest on, and also to receive the stop-studs of the set-plates, and that the holes for the main-studs in the blade-flanges are elongated sufficiently to alter the angle of the blade if required.

A rather novel method has also been used by Messrs. Day, as illustrated by Fig. 30. Bolts are preferred here

FIG. 30.



Messrs. Day's method for securing the heads of screw-propeller flange-studs.

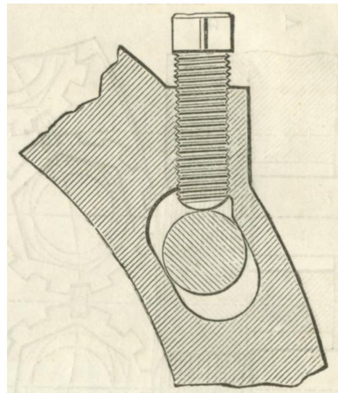
in the place of studs, and the heads are T-shaped, the holes in the boss flange being made to correspond. The main feature is in the nut being grooved at the top across each angle, and a split-pin, passing through the end of the bolt and one of the grooves, prevents the nut from unscrewing; of course there are only three angles in this case that the nut can be screwed up and held to.

Messrs. Humphrys have used the split-pin method also, and the Thames Iron Works Company have adopted double nuts, while the Scottish engineers have used similar means.

The process of altering the angle of the blade of the propeller is a matter of removing all the stop-plates, and loosening the main studs, and then by clamp levers turning the blade to the required position on its seat. Now, the power required to start the flange or break the point, is considerable, and doubtless Messrs. Maudslay were prompted by that fact to design their very simple but efficacious mode for starting and adjusting the blade. It is shown by Fig. 31, which you will see is but a stud—screwed through a projection formed in the flange of the blade—pressing against the flange stud, and thus the blade flange is started. Four of those studs are used with large blades, each situated in the corners of a square limit, and the method of adjustment is thus: if the forward edge of the blade nearest the sternpost were required to be turned towards it, the forward and aft adjusting studs on the left and right-hand sides would have to be turned to force against the two flange-securing studs opposite them, or to be screwed up, while those adjusting studs opposite must be turned to release their contact with the other two flange studs, or unscrewed; and *vice versa* should the blade be required to be shifted in an opposite direction.

I need scarcely inform you, for this is so well known,

FIG. 31.

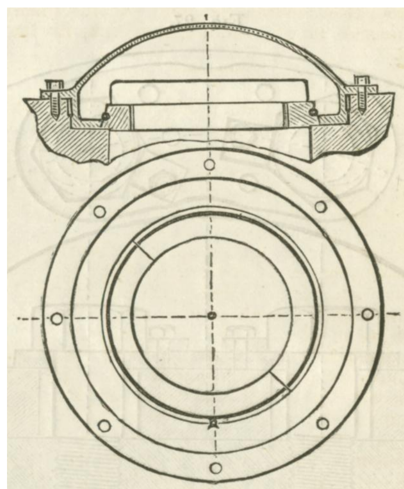


Messrs. Maudslay's method for adjusting the propeller blade.

that Messrs. Maudslay are the patentees and constructors of the only reliable feathering screw propeller, the arrangement of the mechanical appliance being a clutch shifted by bell-cranked levers connected to a screwed rod.

The same firm also has arranged a mechanical means to resist the aft thrust of the propeller on the shaft, and thus relieve the boss cross-keys from the full shearing strain; this is illustrated by Fig. 32. It is that the end of

FIG. 32.



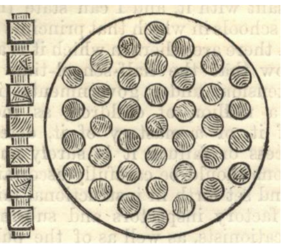
Messrs. Maudslay's arrangement to resist the aft thrust of the propeller on the shaft.

the shaft has a groove turned into it, into which a ring in halves is secured by a metallic cord, and, as the ring presses against the boss, it is prevented from shifting longitudinally. The end and ring are covered by a curved disc that is secured to the boss by studs, as shown in sectional and complete views.

When the propeller is hung in a lifting frame many of the leading firms adopt wooden surfaces in a brass dise, as shown by Fig. 33, which receives the aft thrust of the extremity of the boss, and bears against the back of the frame support.

My descriptive and illustrative matter here terminates, and I now conclude with a few passing observations on what I have laid before you. I have endeavoured to treat this matter in a practical manner, confining my remarks to the subject proper; by leaving out opinions and dealing with facts only, I have steered

FIG. 33.



Wood surfaces in a brass disc to resist the aft thrust of the screw-propeller, as the general practice, 1869.

clear of any ideas as to whether the propeller should be over-hung or suspended between bearings, and thus the lifting-frame and stern-tubing have not been alluded to until now. And my reason for thus confining my remarks is that I knew that if I dragged in any other details but what belonged to the screw propeller, it would be difficult to draw the line of limit. I have omitted also any opinion on the use of twin screws, for I think we all are pretty well satisfied with their utility now. Before I close this paper I may tell you, however, that the main proportions of screw propeller blades depend on the following causes:—The diameter of the propeller depends on the aft draught of the hull; the area of the blade's surface depends on the area of the hull's midship section, displacement, and speed; the number of the blades depends on the velocity of the screw; the length of the propeller depends on the shape of the blades, their number, and area; and the shape of the blade depends on the result of experiment with actual practice.

The CHAIRMAN, in inviting discussion on the paper that had been read, said that some thirty years ago a paper upon this subject would have provoked a great deal of discussion, if not a fierce controversy, and he hoped, although the utility of the screw propeller was now so universally acknowledged, that there was still something to be said with regard to its practical application.

Mr. CAMPIN believed there was a gentleman in the room who had taken out a patent some years ago for a screw propeller with only one blade. He should like to hear what had been the result of what seemed to him at the time rather an extraordinary arrangement.

The CHAIRMAN said that if no one was disposed to enter into a discussion of the mechanical details which had been so ably brought before them by Mr. Burgh, he would at once move a vote of thanks to that gentleman for the paper which he had read, a vote which he was sure would meet with the unanimous approval of the meeting.

The vote of thanks having been carried,

Mr. BURGH said he felt extremely obliged to the members present for the kind manner in which they had listened to his paper, although he must confess to being rather disappointed that no discussion had taken place upon it. He believed there were several engineers present, and if they did not all agree with what he had advanced, they might, at least, have done him the honour to contradict him. His object had been to give, as concisely as possible, information, some of which he believed to be entirely new. In particular, the mode of preventing the screws from becoming loose had only come into use within the last few years, and was a matter of considerable practical importance.

The paper was illustrated by the following models, kindly lent by the firms named:—

Messrs. Maudslay, Sons, and Field—

One large model of their improved adjustable four-bladed propeller.

One large model of their ordinary fixed four-bladed propeller.

Two small models of do.

Two ,, ,, five blades.

Three ,, ,, three blades.

One ,, ,, one blade.

One large model of the stern of a ship fitted with their two bladed feathering screw propeller, with lifting frame and gear complete.

Messrs. J. and G. Rennie—

One full-sized three-bladed screw propeller, as used for steam launches.

Two full-sized two-bladed propellers.

Capt. T. E. Symonds, R.N.—

A model of the method for lifting twin screws.

A large drawing showing the entire arrangement fully applied.

The Secretary called attention to an improved safety lamp, invented by Mr. Thomas Story Horn, and placed upon the table. By a new arrangement of wire gauze and perforated metal plates in the base of the lamp, and perforated metal chimney caps at the top, the inventor believes that the lamp is rendered secure from passing the flame to the explosive mixture of gases in which it may be placed. By the introduction of a metal dome, the air is concentrated at the point of combustion, and thereby an increased amount of light is obtained. The dome also acts as an extinguisher to the flame, should the lamp be overturned. By a new form of lock, picking is rendered difficult. Should the glass chimney be broken, the draft or current of air will be altered and the light become less.

THE ADMINISTRATION OF GRANTS FOR NATIONAL ELEMENTARY EDUCATION.

A numerous deputation of schoolmasters from the London Church Schoolmasters' Association waited on Earl de Grey and Ripon, on Friday, 19th February, to present to him, as Lord President of the Privy Council, a memorial, signed by the teachers of upwards of a thousand schools, on the legislation affecting them. The deputation was accompanied by three of the vice-presidents of the association, by Mr. F. S. Powell, the late member for Cambridge, by Mr. Edwin Chadwick, C.B., and by Mr. Edward Carleton Tufnell, one of Her Majesty's Inspectors of Schools. Mr. Forster, M.P., Vice-President of the Council, attended with Earl de Grey to receive the deputation.

Mr. CHADWICK said—I am requested to support the first resolution of the memorial as an administrative question, and to that resolution I shall confine myself. It states that the schoolmasters "hail as an important advance the proposal made in the Government Bill of last session to appoint a Minister of Education, for they are of opinion that national education is important enough to be made the subject of the undivided attention of a Minister of State, and of a department devoted exclusively to it. And they beg to express a hope that should such an appointment be made, it may be supplemented by the further appointment of permanent officers, chosen for their special qualifications in the actual work of education, who shall undividedly sustain public responsibility for the executive details of administration. And they venture to suggest that under the supervision of such a minister, a department so organised might be extended, so as to embrace the whole field of education, secondary as well as primary." In support of this resolution, I am warranted in declaring, on behalf of the great majority of the school teachers of England, and I might add in behalf of those of Scotland, that this Department, as at present organised and by reason of its organisation, does not possess their confidence or the confidence of those most conversant with the subject matter of its administration; and has ceased to have that moral weight amongst them which a superior public administrative body, charged with most important duties, ought to have. In my

view this has arisen in great part from the fragmentary and imperfect character of its functions, and its want of practical and comprehensive information for its guidance. Intending to promote efficiency and economy in the administration of the funds entrusted to it, for want of competent knowledge and skill it has misapplied the now important administrative principle of payments for results. It has, according to the impartial testimony of its most experienced inspectors, lowered the quality of the primary elementary instruction, which required elevation; it has degraded the elementary education of the people, and thence produced inferior and, therefore, wasteful results. It has, by the revised code, dealt unjustly with the status of the pupil teachers, which it has lowered, and through them it has struck at and crippled the training colleges—in themselves the most important and beneficial educational institutions of our time in this country. In ignorance, or in neglect of the aphorism, "as is the master, so is the school," it has through him lowered the school. As one example of its administration, I must mention its dealing in a matter with which I happen to be specially conversant. Year after year its inspectors in their reports presented examples of the bad sanitary condition of many of the common schools, in aid of which the public money had been expended, and which were sources of preventible disease to teachers as well as to the pupils, but nothing appears to have been done—no reference made to the health-inspectors of the council, who might have been fitly employed upon the matter. The medical officers of health of the metropolis had schools of this class brought within their cognizance as fever nests, centres for the spread of epidemic diseases amongst children and families. On their knowledge of particular schools within their respective districts, these medical officers ascribed an excess of seven thousand deaths annually of children in the metropolis, as due in great measure to the condition of these schools, and, apparently, an excess of no less than fifty thousand deaths of children in the school stages throughout the country. The Association of the Medical Officers of Health deemed it their duty to bring the case, by a memorial, under consideration of the Department, but they got no attention to it. At their request I headed a deputation of them, who brought the case under the notice of Lord Palmerston. He recommended them to try the Department again, and there the matter ended, and the evil, the destruction of infantile life from ignorance and inattention, yet goes on year after year. Now, France has got a special department of education of another organisation, unmixed up with other and disparate functions, which is presided over by a Minister of Public Instruction. Recognising the fact that the proper culture of the mind involves some care of the body, and the sanitary condition of the schools and treatment of the pupils, on a lesser complaint the Minister directed an examination of all the lycées of the Empire, by a competent sanitary officer, whose report, comparing one school with the other on all points, the condition of the sites and the structures, the sanitary treatment of the pupils, I have read, and it is fraught with valuable suggestions of measures of present amendment, and important precautions for future guidance in the extension of educational institutions. I have a letter from a distinguished Conseiller d'Etat of France, who says, that whilst they envy us our individual initiative, our local efforts, and our large private educational associations, they are nevertheless convinced that a well appointed Minister of Instruction, and an efficient central department is necessary to aid all such local and private effort, and to do what such effort does not do, and cannot do; and of this the instance I have given may serve as an example. One function of such a department is to collect local experience, and to obtain a thorough mastery of leading principles and promulgate them for local guidance. I submit two examples of failure in this respect. Having, as a commissioner of inquiry in the labour of young children in factories, prepared the provisions for the half-school-time system, I am conversant with it, and I can state that there are conditions of schools in which that principle of teaching is a failure, and there are others in which it is a pre-eminent success. Now that the half-school-time system is in course of extension, under governmental inspection, to upwards of a million of children, as indifference or ignorance of it, or a mastery of it, determines comparative success or failure, it is surely important that these conditions should be carefully ascertained and discriminated, and set forth in instructional minutes for the guidance of factory inspectors and sub-inspectors who are not educationists, as well as of the public at large, particularly at this time, when there is a question as to the application of the principle to the children of the agricultural classes, and when agriculturists are giving evidence upon it, who know little, if anything, about it. I am aware that your Lordship and your colleague know about the half-time system, as you have had it brought under your notice in the half-time schools in Yorkshire, which I have myself examined. But I can state that there are other, and advanced, and varied applications of the principle in other parts of the country which you cannot have seen, and probably have not heard of, which are specially important for the protection of children not engaged in factory or any other productive labour. The particular attention of your inspectors has never been directed to the subject; those I have met with are yet strange to it, and it may be said that, important as it is, the Department really has not proper knowledge of it. None is to be traced in its reports or in its actions. To present another example. There are the common conditions of school organisation and teaching, in which it requires six years, even with good teachers, to impart the common elementary instruction, reading, writing, and arithmetic, comparatively ill; and there are other conditions, now demonstrated by years of experience, in which they are taught comparatively well in three years, at an expense of one pound per head for the superior teaching power, as against thirty shillings or two pounds per head for the comparatively inferior teaching; or, in other words, there are conditions in which three or four are taught comparatively well, at the total expense at which one is taught comparatively ill. Moreover, with the good teaching of the three R's—generally on the half-time system—a bodily training is given, by gymnastics and the military drill, which imparts to three the efficiency of five for ordinary labour. It is manifest, from its course of action, that the Department has been uninformed of the experience of these conditions, though they are large and fundamentally organic, and, for economy as well as efficiency, must govern the whole field of national elementary education. In correct administrative principle, an educational department should be an agency for carefully collecting the results of experience from the whole field of service, not only for its own direct guidance, but for distributing it for the guidance of all isolated officers and people who may be engaged in the service. As a minister of education, Mons. Guizot lays it down as an administrative principle, that it is the duty of a government or of a department to make itself acquainted with all successful methods, to attend to all important trials, to promote all improvements, and to promulgate the knowledge of them to all who are employed in the service. The French Minister of Instruction performs this duty; circulars of information are distributed to all the schoolmasters, questions are asked of all of them direct, and each has the privilege of answering direct to the superior authority. I might present examples of valuable information for the guidance of the minister and public service thus obtained. Conferences are had with them, and discussions amongst them on the progress of their art are officially encouraged. But this committee of the Privy Council does nothing of the sort. Whilst the educational functions here are so imperfect,

lame, halting, and torpid, there are Governmental functions in respect to elementary education—functions of the control and direction of the public expenditure for elementary education, which, for efficiency and economy, ought to be under one competent superior head, but they are scattered about so capriciously amongst different "authorities" of inferior competency as to narrow the experience of each and to beget both waste and inefficiency. Thus there are educational functions, in respect to the elementary education of a great number of orphan children confided to the Poor-law Board, dependent upon the accidental competency and zeal of inspectors, who are under no proper superintendence, who have to report to changing political chiefs, who generally know nothing, and care nothing, whether the inspection is done well or ill, whether the education given is good or bad;—and there is evidence that much of it has been very bad. Then, there are educational functions in respect to elementary education, the teaching the three R's in the army schools, under the independent direction of the War Office, acting through a Council chiefly of superior military officers who are not educationists, though, I must say, that having urged upon the attention of the first Council the half-time principle, they adopted it, and that it is fairly carried out, at all events in the Chelsea school, by an able master, Mr. Macleod, who is here as one of our deputation. Then there are functions of elementary education of children for the navy, under the independent direction of the Lords of the Admiralty, whose incompetency I apprehend it will be fully conceded has been displayed in the reports of the different management at different times of the large Greenwich school. Now, in respect to these three departments, poor law, naval and military, it may be proved that the experience gained in one is lost to the others, and that had the same elementary functions been exercised by well constituted authority, the experience of one branch in cost of maintenance and training would have shown that half the money expended by the other two might have been saved to the public, and better results have been obtained. Then there are independent governmental educational functions—of all places!—cast amidst a mess and medley of functions in respect to the public health—functions as to gas and water supplies, testing anchors, looking after alkali works, shipwrecks, and what not—the Board of Trade. But above all there is an annual income of some million of money in educational endowments, mainly for the poorest classes and for elementary education, and charities left for the good of the poor (whose greatest practical good would be mixed physical and mental training to impart aptitude for productive industry), and this large sum of money, equivalent to the Parliamentary educational grant, is expended, as is proved, for the most part, in worse than waste, under Governmental functions of supervision, control, and direction by the Court of Chancery, which knows nothing of the educational art, which cannot be informed upon it except at a ruinous expense, whose unfitness for the exercise of such power has been declared by the President of our association, the present Lord Chancellor, as well as by other law lords. For myself, I beg leave to submit that it would well task the undivided attention and labour of a Council, specially conversant with the art of education, and also with the principles of educational organization, to stay this Governmental waste and inefficiency, by collecting these scattered Governmental functions together, and getting them in good efficient, uniform, and economical action, as a preparation for dealing with local waste and inefficiency by a general measure for a middle-class national elementary education, including what cannot moreover be dealt with separately from lower class education except at great loss. I may state, for the schoolmasters generally, that their experience and observation does not lead them to expect that the progress required will be obtained by the transient effort of any ability and zeal, with only a divided and distracted attention and imperfect information, the result of divided fragmentary unsystematised and imperfect functions, such as those I have exemplified.

Mr. Tufnell showed that whilst, by the Revised Code, the number of the candidates for pupil-teacherships had been so reduced by the discouragements it gave to them, that the training colleges found it difficult to get on—that two had been given up and the rest crippled, and that the qualifications of those admitted as pupil teachers had been grievously reduced; so that a system which had produced the best trained teachers in Europe had been ruinously affected by the maladministration of the Department. Dr. Cromwell, the principal of the St. Mark's Training College, referred to the impartial evidence given before the Duke of Newcastle's Commission on the superior results and economy of trained teaching. Mr. Daniel, the Principal of the Battersea Training College, exemplified the injury done to the public by the course taken by the Department on that topic. Mr. Lawson, of St. Mark's College, spoke of the discouragement to competent school teaching from its disadvantage as compared with other branches of service from the want of retiring pensions or annuities, which had occasioned numbers of the most valuable trained teachers to abandon the elementary schools for more remunerative pursuits. Other speakers displayed the fallaciousness of the returns as to the results obtained, and to the inadequacy of the tests by the examinations of the inspectors, from their very frequent want of skill. Apprehensions were expressed of the effect of an educational rate, in subjecting the trained teacher to the caprice or ignorance of Local Boards; and confidence was manifested that religious teaching would be the most safely confided to the trained teacher. Earl de Grey and Ripon assured the deputation that attentive consideration would be given to their representations. It was from the deep sense of the importance of the whole subject that the Government had postponed the question, that they might give it the most mature examination. His lordship observed that his friend Mr. Chadwick, in what he had said on the subject of a minister of public instruction, had not sufficiently taken into account the difference of local conditions to be dealt with in England as compared with France. Mr. Forster assured the school teachers that he regarded their present position with much sympathy.

Fine Arts.

STATUE TO CALLOT.—The Art Society of Nancy has determined to raise a statue in honour of the celebrated Jacques Callot, who was a native of that place. The work is to be raised by subscription.

BUSTS PLACED IN THE HÔTEL DE VILLE, PARIS.—Busts in marble of Queen Victoria and the late Prince Consort, the Emperor of Russia, the King of Prussia, the King and Queen of the Belgians, the King of Bavaria, and the Sultan, all of whom have visited the fine old building of Henry IV. since 1854, have recently been placed in the galleries of the Hôtel de Ville.

Commerce.

THE DUTCH HERRING FISHERY.—The herring fishery to the north of the Shetlands and Hebrides, carried on by Dutch fishermen during the last season, has proved to have been more successful than that of the previous one in 1867, in spite of a great deal of rough weather. The number of boats engaged in this fishery was 153, manned by 1,200 men and boys. During the five months these boats made 778 voyages, and the number of fish brought to market was 64,308,860, not including the 2,081,400 the share of the owners, and those which were salted or cured.

Sale of Provisions at Turin.—The following quantities of provisions were sold in the Piazza Emanuele Filiberto (the principal market at Turin) during the past year:—Cereals (wheat, rye, barley, oats, rice, and maize), 1,258,945 hectolitres; poultry (chickens, geese, ducks, capons, turkeys, &c.), number of head, 833,640; fresh water fish, 14,671 myrias; vegetables, 188,275 myrias; fruit, 265,375 myrias; butter, 39,330 myrias; firewood, 1,171,158 myrias; charcoal, 262,450 myrias; hay and straw, 301,723 myrias; wine, 66,691 hectolitres. The following were the number of head of cattle slaughtered for food in Turin during 1868:—Bullocks, 8,852; calves, 22,658; oxen, 3,987; cows, 1,167; heifers, 352; pigs, 5,178; sheep, 7,592; lambs, 29,746; goats, 17,325; total, 96,857.

Colonies.

Victorian Railways.—It is evident that this system of lines is beginning to be more thoroughly appreciated as a means of rapid and safe transit for goods, and there is every reason to believe that under a management that worked the railways economically, and served the country cheaply, they would fully answer the purpose of their construction, the development of the resources of those districts through which they pass. This is apparent from the fact that it is the greater amount of goods and minerals carried which gives, from week to week, the advance on the returns of the previous year. In the statement for the week ending 24th December, 1868, for instance, the carriage of goods and minerals produced £7,441 4s. 11d., against £5,231 15s. 6d. in the corresponding period of 1867, an increase of over £2,209. But the passenger traffic gave only £6,617 5s. 10d., against £8,191 10s. 11d. in the same week of 1867, a decrease of £1,754, and this notwithstanding the issue of third-class and excursion tickets. The general statement is as follows:—Total receipts for the week, £14,756 18s. 11d., as compared with £14,080 6s. in the same period of 1867; aggregate to this date, £571,530 16s. 8d., as against £541,996 3s. 2d.; weekly average for the 51 weeks, £11,206 9s. 8d. against £10,627 7s. 6d.

Manufacture of Whips in Victoria.—A former manufacturer of whips in Birmingham has started a whip factory at a place called Footscray, in this colony. He found a great local demand for whips, and also that several of the raw materials which the manufacture required could be obtained at Footscray for an almost nominal cost. The adjacent abattoirs supply him with an abundance of sheeps' intestines, from which he makes his catgut. The rattan cane, which enters largely into the interior of a whip, comes as dunnage in rice and sugar ships from India. With these and similar advantages, in spite of the scarcity and cost of skilled labour, it is found possible to supply the colonial market with a more suitable article, and at a lower price than English manufacturers. Probably in time the value of the refuse of the abattoirs, and of the dunnage of the rice ships, will be fully understood at Footscray, as it is in England, but by that time the business will have thoroughly acclimatised.

Gold in Queensland.—A Brisbane paper says:—"Scarcely a week passes but information comes to hand of the discovery of auriferous ground, until, at last, it is reasonable to expect that it will soon be impossible to point to a district here where it is known that gold does not lie in the earth, only waiting to be developed by the hands of man. As a suitable field for intending gold diggers, in fact, Queensland stands amongst the first in the list of auriferous countries at present known. There can be scarcely a limit to the progress of that mainstay once capital labour and skill are fairly embarked in it, and it is evident that such a state of things is being rapidly brought about in consequence of the increasing knowledge that is being obtained elsewhere of our resources."

Obituary.

Lamartine.—The poet and statesman Alphonse de Lamartine expired at the residence presented to him by the City of Paris, at the edge of the Bois de Boulogne, on the Passy side, in the 79th year of his age. The Government decreed that, "on account of his services to his country in a time of great difficulty," the interment of his remains should, like these of the late M. Troplong, President of the Senate, be at the expense of the State, but the expressed desire of Lamartine that there should be no pomp or ceremony at his funeral induced his relatives and friends to decline the proposal. The remains were conveyed to Mâcon by railway, and there the funeral service was performed in the presence of a small number of friends, and a few representatives of art and literature. They were then conveyed to the family vault at St. Point, a distance of some leagues, the whole population of the villages on the route, headed by the clergy, lining the road. At St. Point the assemblage was immense. The vault contains the remains of the father and mother of the deceased, of Madame de Lamartine, an English lady, who died a short time since, of the daughter and only child of the poet, and of a faithful English nurse who desired to be buried there. The only ceremony consisted in an escort of twenty-five soldiers, on account of the deceased being a Chevalier of the Legion of Honour. A subscription has already been set on foot for the erection of a suitable memorial in honour of the deceased.

Notes.

Agricultural and Horticultural Shows in France.—The season of the annual exhibitions and competitions connected with agriculture is approaching, and the various provincial societies are this year actively engaged in organising supplementary exhibitions and congresses to add to the interest of the official meetings. We have already noticed the arrangements for Chartres, and are now enabled to add some others. The exhibition announced to take place at Beauvais, from the 1st June to the 15th July, will include agriculture, industry, and horticulture; Poitiers is to have industrial, artistic, and archæological exhibitions for the important departments of Vienne, Charentes, Dordogne, Gironde, Deux Sèvres, and Vendée; the Horticultural Society of the Eure and Loire announces an exhibition, to be held from the 5th to 17th May, for productions of the market garden, the pruning of trees, nursery gardening, and floral cultivation; the Horticultural Society of Allier holds its show at Moulins, from the 22nd to 25th of April; the Horticultural Society of Melun and Fontainebleau, a district famous for grapes and roses, and, indeed, for fruits and flowers of all kinds, announces that its spring exhibition will take place at Montereau, on the 16th and 17th of May; an exhibition of trained horses is to take place at Alençon on the 17th March instant, when prizes of £32, £36, and £48 will be awarded by the juries. The sum of £480 is devoted to the purposes of this competition. The Comice Agricole of Montluçon, in Allier, announces its meeting for the 30th instant, prizes to be awarded for the best breeding bulls, cows, sheep and pigs, poultry, and agricultural implements; there will also be competitive trials of agricultural labour.

Paris Academy of Sciences.—The French Academy of Sciences, at its last meeting, elected Dr. David Livingstone a corresponding member of that body in the section of geography and navigation, in place of the late Mr. Dallas Bache, of Washington.

Working Men's Clubs in France.—The proposal for establishing working men's clubs at Mulhouse, mentioned in the *Journal* of January the 22nd, has been followed by the announcement of the formation of a club of mechanics at Marseilles, and an Imperial decree has sanctioned the association in question, which is therein declared to be an establishment of public utility.

Correspondence.

Army Organization.—Sir,—The copy of your *Journal* for the 19th of February, containing the paper read by Mr. Henry Cole, C.B., on the efficiency and economy of a national army, having been sent to me, I have very carefully gone through the same, as also the observations made thereon by Major-General Sir William Denison, who, stating that the subject had been treated by Mr. Cole in the loosest possible manner, proceeds himself to treat it in that spirit of contempt for all who differ from him, and especially for civilians, which always forms a striking feature in the language and deportment of military officers. I have seldom read anything more clear and conclusive than the facts, arguments, and authorities adduced by Mr. Cole in support of the proposition that a standing army such as ours is a national weakness, and that to recur to the ancient and constitutional system of making every man contribute to the defence of the country is not only essential for our safety, but would of itself tend to elevate the moral character of the nation, while it relieved us of an expenditure that, to the extent of seven or eight millions a year, is far worse than utterly wasted. Such being the opinion I have long entertained, sustained, as I believe it to be, by the experience of our volunteer system, I beg leave to convey through you my best thanks to Mr. Cole for his most able elucidation of the subject; and, as a Member of Parliament, I shall at all times be prepared to promote to the utmost of my power the policy advocated by him.—I am, &c., G. H. Whalley.

Plas Madoc, Rhuabon, 27th February, 1869.

Schultze's Granulated Wood Gunpowder.—Sir,—I beg to state, for the information of the gentlemen who witnessed the experiments upon this composition, on the 27th of January, at Wandsworth, that the white powder accidentally bearing my name possesses all the properties ascribed to Captain Schultze's compound, the manufacture of which, depending in some measure upon the gun-cotton process, renders it subject to some of the inconveniencies attendant upon that process never yet entirely overcome. The manufacture of white powder will not cost more than one-tenth of the time, labour, machinery, and chemical experience required for that of the proposed granulated wood-powder, and it may be made, at present prices, for one shilling per lb.; its cost, on a large scale, would of course be much less. The explosion of white powder-mills would be impossible, as the materials never come together except in such quantities as may be required for immediate delivery, when the manufacture is completed in a few minutes by means of a large revolving conical sieve. It is only when ready for filling the cartridges that it becomes as dangerous as common gunpowder, but not more so, more especially as it cannot leak out so as to form explosive trains. From its compact nature it only occupies half the usual space in the chamber of the gun, none being blown out of the muzzle unconsumed, as is the case with all granulated powders. The whole of the charge is usefully expended in producing initial velocity, and consequent length of range or depth of penetration. The explosion of white powder producing four times the propelling force of the best black, leaves the barrel perfectly dry, and whatever slight carbonaceous deposit may remain is blown out at each successive discharge, and no fouling ever takes place. Its general introduction will, moreover, allow of a considerable reduction in the dimensions of fire-arms of every description to do the same work now performed by ordinary black powder. I can only say that I have made it for my own use, and have used it continually for ten or twelve years, and never yet had the slightest approach to an accident.—I am, &c., Henry W. Reveley.

1, Baker-street, Reading, Feb. 22.

MEETINGS FOR THE ENSUING WEEK.

Mon......Society of Engineers, 7½. Mr. C. M. Barker, "Joints for the Prevention of Leakage in Gas and Water Mains."
R. United Service Inst., 8½. Capt. Edmund Wilson, R.N., "Working Heavy Guns on the Broadside; with some Observations on the all-round fire combined with the broadside system of Armament."
Entomological, 7.
British Architects, 8.
Statistical, 4. Anniversary Meeting.
Medical, 8.
Asiatic, 3.
Victoria Inst., 8.
London Inst., 6.

Tues ...Royal Inst., 3. Rev. F. W. Farrar, "On Comparative Philology."
Civil Engineers, 8. Discussion, "American Locomotives and Rolling Stock."
Statistical, 8. Mr. James Caird, "On the Agricultural Statistics of the United Kingdom."
Pathological, 8.
Anthropological, 8.

Wed ...Meteorological, 7.
Society of Arts, 8. Mr. W. Davison, "On the Trade and Commerce of Japan."
R. Society of Literature, 4½.

Thur ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. J. G. Baker, "Monograph of British Roses."
Zoological, 4.
Chemical, 8.
Numismatic, 7.
Philosophical Club, 6.
Royal Inst., 3. Dr. H. Power, "On the Eye."
Society of Fine Arts, 8. Second Musical Evening (Schumann and Schubert). Conductor, Mr. Alfred Gilbert.

Fri ......Philological, 8½.
Royal Inst., 8. Dr. Crum Brown, "On Chemical Constitution."
Quekett Club, 8.

Sat......Royal Inst., 3. Dr. Odling, "On Hydrogen."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 2nd March, 1869.*

21. Bill—Assessed Rates.
23. „ Marriage with a Deceased Wife's Sister.
27. „ Irish Church.
36. Post Office (Mail Service)—Contract.
16. National Debt (Savings Banks and Friendly Societies)—Accounts.
30. Bank of England—Annual Account.
40. Navy Estimates—(Corrected Pages).
45. Metropolitan Improvements—Statement.

Session 1868.

119. (xi.) Trade and Navigation Accounts (31st December, 1868).
Lords Address.

Delivered on 3rd March, 1869.

25. Bill—Evidence Amendment.
26. „ Court of Common Pleas (County Palatine of Lancaster).
28. „ Sea Birds Preservation.
30. „ Metropolitan Commons Supplemental.
31. „ Inclosure of Lands.
24. Metropolitan Board of Works—Returns.
32. Greek Loan—Account.
33. Sardinian Loan—Account.
49. Abyssinian Expedition (Vote of Credit)—Supplementary Estimate.
Public Petitions—Third Report.

Session 1868.

344. (A viii.) Poor Rates and Pauperism—Return (A).

Delivered on 4th March, 1869.

15. Bill—University Tests.
29. „ Sale of Liquors on Sunday (Ireland).
31. Russian Dutch Loan—Account.
43. Navy—Supplementary Estimate.
46. Trade and Navigation Accounts (31st January, 1869).
50. Post Office Packet Service—Statement of Excess.
51. Civil Services—Statement of Excesses.
Education—Revised Code.
Turkey and Greece—Correspondence.

Delivered on 5th March, 1869.

24. Bill—Stannaries.
33. „ Burials Regulation.
19. Public Income and Expenditure—Account.
35. Mint—Account.
47. Bankruptcy Act—Return.
Inland Revenue—Twelfth Report of Commissioners.

Delivered on 6th March, 1869.

22. Bill—Beerhouses, &c.
32. „ Game Laws Amendment (Scotland).

34. ,, Lands Clauses Consolidation Act Amendment.
35. ,, Life Assurance Companies.
36. ,, Game Laws (Scotland).
37. ,, Pharmacy Act (1868) Amendment.
54. Piers and Harbours—Report of the Board of Trade.
61. Navy—Appropriation Account.
64. Committee of Selection—First Report.
Public Petitions—Fourth Report.

SESSION 1868.

433. (IV.) Endowed Charities—General Digest.
494. Local Government Act (1858)—Tenth Annual Report.

Delivered on 8th March, 1869.

20. Bill—Married Women's Property.
38. ,, Contagious Diseases (Animals) (No. 2).
29. Dublin City Election—Minutes of Evidence.
34. Court of Chancery—Return.
53. Bank of England—Applications for Advances to Government.

Patents.

From Commissioners of Patents' Journal, March 5.

GRANTS OF PROVISIONAL PROTECTION.

Anchors—503—W. Daines.
Artificial stone—548—B. J. B. Mills.
Artificial teeth—542—J. O. C. Phillips.
Boilers—537—R. Foster.
Bricks, &c.—453—W. Basford.
Bricks, &c.—578—W. H. Tooth.
Buddles for separating ores, &c.—524—G. Green.
Butt-hinges—534—B. F. West.
Cartridges, wadding for—462—C. W. Lancaster.
Cast-steel, &c.—566—H. Bessemer.
Chimneys, &c., cowls for—518—E. Hewett.
Churns, &c.—514—S. Myers.
Coke ovens, &c.—558—A. Jobson.
Combustible liquids, burning and vaporising—523—G. G. Hairs.
Corks, drawing—527—J. Mabson.
Cotton, &c., winding on reels—526—J. T. Wibberley.
Electrical conductors—531—M. Gray.
Electric telegraphs, &c.—501—D. G. FitzGerald.
Fans, rotary blowing—490—H. Aland.
Felt carpeting, &c.—398—W. Mitchell.
Fire-arms, breech-loading—511—A. Henry.
Flannel, &c., treating—515—T. Smith.
Flax, &c., machinery for spinning—502—J. Newton.
Flour, apparatus for treating—3707—A. V. Newton.
Flowers, apparatus for gathering—554—J. Blyde.
Furnaces—569—J. Whitehead.
Furnaces, &c.—586—W. E. Newton.
Gas, manufacturing—575—R. Morton.
Gas pipes, &c., laying and joining—571—W. Wililams.
Gas, recovery of substances used in the purification of—565—S. Holroyd.
Glass, &c., producing designs upon—576—G. Rees.
Grate bars—557—J. T. Gaze and J. Hymas.
Hair-cutting machines, &c.—532—J. H. Morl.
Harvesting machines—577—J. T. Griffin.
Hats, &c.—555—H. F. Freutel.
Horse-shoes—454—W. Haycock and W. Carter.
Human figure, apparatus for measuring the—3919—G. M. Wolmershausen.
Hurdles for folds—552—J. B. Rushbrook.
India-rubber suction pipes, &c.—507—T. Forster and P. B. Cow, jun.
Iron and steel—546—T. S. Blair.
Lamps for lighting mines—3505—M. Wilkin and J. Clark.
Linen-faced paper, compound for glazing—533—T. H. Simmonds and E. B. Moreland.
Locomotive engines—564—A. V. Newton.
Locomotive engines and carriages—517—A. M. Clark.
Locomotive engines, heating apparatus for—544—W. R. Lake.
Locomotive engines, &c—553—R. Meldrum.
Looms—480—T. Sagar and T. Richmond.
Looms—497—C. Brook, L. Barker, and M. Thompson.
Looms—509—T. Tunstill and J. Dodgeon.
Malting, heating, &c., apparatus for—539—J. and W. Weems.
Metallic articles, shaping and finishing by abrasion—582—B. P. Walker.
Metallic capsules, applying trade-marks, &c., upon—563—J. Neilson and J. Marshall.
Metallic salts and sulphuric acid, utilising waste—574—J. I. Vaughan.
Meters for measuring water, &c.—535—F. G. Fleury.
Mineral and rock drilling apparatus—492—J. Darlington.
Mines, ventilating—536—J. Daglish.
Motive-power engines—397—G. White.
Motive-power engines—516—J. Davey.
Ornamenting surfaces—327—J. Macintosh.
Ornamenting surfaces—505—M. Vary.
Oyster dredges—323—W. Brabazon.
Paper, manufacture of—540—W. Ibotson, W. W. Ladelle, and A. G. Southby.
Parasols, &c.—588—L. Engel.
Pianofortes—562—W. F. C. Moutrie.
Printed paper, drying and pressing—496—J. D. Nichol & J. Eckersley.
Printing, apparatus for—549—J. E. Liller.
Railway carriages, &c., steps for—498—R. Pyne.
Railway crossings and switches—556—R. P. Williams.
Railway trains, communication in—568—J. J. Myers.
Railways—522—M. MacLennan.
Reaping and mowing machines—541—S. Osborn.
Rotary engines, &c.—560—J. Johnson and W. Gill.
Screw wrenches—551—W. E. Newton.
Sewage, removing and utilising—506—F. Delbreil.
Sewers, ventilating—528—A. Jacob.
Sewing needles, machines for making—504—F. W. Mallett.
Ships, propelling—529—J. Eberhard.
Ships, propelling—545—G. A. Fall.
Signal lamps—459—E. J. Hill and R. Davis.
Solitaires, links, &c.—383—R. W. Row.
Spinning machines—573—B. Hunt.
Steam engines—519—H. T. and T. Jennings.
Steam engines, &c.—500—T. H. Martin.
Steam engines, &c.—525—J. D. Gauldie and T. A. Marshall.
Steam engines, &c.—572—J. Cooke and G. Hibbert.
Steam generators—513—J. Loader.
Steam, utilising waste—3307—R. Meldrum.
Stone, &c., cutting—494—A. Munro and W. B. Adamson.
String holders—495—A. Garrison.
Taps—559—J. Breeden.
Tenons and mortises, making—570—W. A. Ives.
Velocipedes—550—J. H. Johnson.
Velocipedes—580—W. Anyon.
Velocipedes, floating—538—J. E. Lucas.
Vessels for containing water, &c.—508—W. M. Cochrane.
Vessels, &c., mooring—584—J. Moody.
Vices—567—W. E. Gedge.
Water, apparatus for heating—520—J. Barton.
Weavers' harness or healds—590—W. R. Harris.
Windmills, feathering sails for—512—L. G. Moore.
Windows—493—A. Bartholomew.
Wool, &c., combing—530—H. W. Whitehead.
Wool, &c., winding slivers of—547—J. and T. Leach & J. Goodyear.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Lawn mowing machine—625—W. R. Lake.
Ships—639—J. Howe, jun.

PATENTS SEALED.

2740. I. L. Pulvermacher.
2757. J. C. Walker.
2759. C. Holland.
2762. J. Burdett.
2764. A. J. Fraser.
2775. J. Adams and H. Barrett.
2783. T. Bennett.
2794. A. Cruls.
2805. G. Bischof, jun.
2814. E. Turner.
3301. P. B. Cow and J. Hill.
3772. F. Walton.
3875. T. Warwick and A. Boyle.

From Commissioners of Patents' Journal, March 9.

PATENTS SEALED.

2788. J. Maynes.
2792. J. Challender & B. Kitchen.
2803. E. T. Hughes.
2806. J. Roberts.
2813. F. Warner.
2835. F. Brady.
2840. R. Martin.
2847. J. Orrin and T. Geer.
2857. W. Betts.
2870. J. H. Johnson.
2881. W. Needham and J. Kite.
2884. G. Bernhardt.
2893. B. Dickinson.
2894. B. Dickinson.
2901. N. Stevenson.
2996. W. E. Newton.
3137. W. Yates.
3174. J. Ashcroft.
3234. C. D. Abel.
3316. W. Brown.
3609. W. R. Lake.
3950. W. R. Lake.
3983. B. Samuelson.
76. J. Knowles.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

653. W. Clark.
676. J. Broadbent.
784. E. Tonks.
1023. J. Sparrow and S. Poole.
740. P. H. Ashberry.
671. C. W. Siemens.
683. J. Norman.
702. J. G. Willans.
703. G. E. Donisthorpe.
738. M. P. W. Boulton.
761. J. W. Yates.
688. W. Richards.
727. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

596. W. Tongue.
612. J. Fowler, jun., D. Greig, and R. Noddings.
625. J. Platt and W. Richardson.
657. E. G. Camp.

Registered Designs.

4997—Feb. 5—Refrigerating tankard—H. C. Ash, 315, Oxford-street, W.
4998—Feb. 11—Portable lamp—F. West, St. James's-street.
4999—Feb. 16—Sleeve link and other dress fasteners—Cooper Bros., Birmingham.
5000—Feb. 19—Letter or bill file or clip—Windle and Blyth, Walsall.
5001—Feb. 22—Harmonium case—J. H. Croft, 144, Westminster-rd.
5002—March 4—Reversible file—J. Gray, Sheffield.
5003—March 6—Apomecometer—R. C. Muller, Great Brunswick-street, Dublin.